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APPEAL BRIEF

Applicant	:	Denney et al.
App. No	:	10/690,833
Filed	:	October 22, 2003
For	:	LASER HEAD FOR IRRADIATION AND REMOVAL OF MATERIAL FROM A SURFACE OF A STRUCTURE
Examiner	:	Elve, Maria Alexandra
Art Unit	:	1793

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Bruce S. Itchkawitz, Reg. No. 47,677

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants (Appellants) are appealing the rejection of Claims 1-22 of the present application as stated in the Final Office Action mailed on January 11, 2008 and as reaffirmed in the Notice of Panel Decision from Pre-Appeal Brief Review mailed March 11, 2008.

This Appeal Brief is being filed within two months from receipt of the Notice of Appeal on February 29, 2008. Enclosed with this Appeal Brief is the fee set forth in 37 C.F.R. § 41.20(b)(2). Please charge any additional fees, including any fees for additional extensions of time, or credit overpayment to Deposit Account No. 11-1410.

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I. REAL PARTY IN INTEREST

The real party in interest of the present application is the Assignee, Loma Linda University Medical Center.

II. RELATED APPEALS AND INTERFERENCES

Appellants hereby notify the Board of Patent Appeals that Appellants have filed a Notice of Appeal and Pre-Appeal Brief Request for Review in related U.S. Application No. 11/401,116, entitled "Manipulation Apparatus for System that Removes Material from a Surface of a Structure," and U.S. Application No. 11/401,114, entitled "Method and Apparatus for Material Processing." Appellants' Legal Representative, and the Assignee do not know of any other prior or pending appeals, interferences, or judicial proceedings which may be related to, directly affect or be directly affected by or have any bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-22 are currently pending in the application. A copy of the claims is attached hereto as an appendix. All of the pending claims were finally rejected by the Examiner in the Final Office Action mailed January 11, 2008. Rejected Claims 1-22, as they stand rejected in the January 11, 2008 Final Office Action, are the subject of this appeal.

IV. STATUS OF AMENDMENTS

Appellants have not proposed any amendments to the claims subsequent to the January 11, 2008 Final Office Action. Therefore, Claims 1-22 are currently pending.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to a laser head for irradiation and removal of material from a surface of a structure.

Claim 1 recites a laser head adapted to irradiate an interaction region of an inhabitable structure with laser light to remove material from the structure. The laser head includes a housing, as well as a connector coupled to the housing and optically coupled to a laser generator.

The connector is adapted to transmit laser light from the laser generator. The laser head also includes at least one optical element contained in the housing and optically coupled to the connector, the optical element being adapted to receive laser light from the connector. The laser head also includes a containment plenum which is coupled to the housing. The containment plenum is optically coupled to the optical element to receive the laser light from the optical element. The containment plenum is also adapted to confine the material and remove the material from the interaction region resulting from irradiating the structure with laser light. The containment plenum is cooled by a cooling medium flowing through a coolant conduit of the containment plenum, the coolant conduit being fluidly coupled to a source of the cooling medium that is spaced from the containment plenum.

Example embodiments are shown in Figures 3B, 3C, and 4 of the present Application. The example embodiments of the laser head 200 shown in Figures 3B and 3C include a housing 230. (*See, e.g.*, *Application at* ¶¶ 65, 66.) The housing 230 is coupled to a connector 210 and is coupled to a containment plenum 240. (*See, e.g.*, *Application at* ¶¶ 65, 66.) The connector 210 receives laser light from a laser generator 310. (*See, e.g.*, *Application at* ¶ 66.) The laser light is directed through the housing 230 by at least one optical element (e.g. lens 233 and mirror 235), and through the containment plenum 240 onto the structure. (*See, e.g.*, *Application at* ¶¶ 66-68.)

The example embodiment of a containment plenum 240 shown in Figure 4 includes a plenum housing 242, a window 243, a nozzle 244, a resilient interface 246, an extraction port 248, and a compressed gas inlet 249. (*See, e.g.*, *Application at* ¶ 73.) The containment plenum can be cooled. (*See, e.g.*, *Application at* ¶ 73.) Coolant conduits for the plenum housing 242 and/or for the nozzle 244 can be coupled in series or in parallel with the coolant conduits for other components of the laser head 200. (*See, e.g.*, *Application at* ¶¶ 73, 77.)

Claim 19 recites a laser head adapted to irradiate an interaction region of an inhabitable structure with laser light to remove material from the structure. The laser head comprises means for connecting the laser head to a laser generator, means for receiving the laser light from the laser generator, means for guiding the laser light to the interaction region, and means for confining the material and removing the material from the interaction region. The confining means are cooled by a coolant medium flowing through a coolant conduit of the confining

means. The coolant conduit is fluidly coupled to a source of the cooling medium that is spaced from the confining means. Example embodiments are shown in Figures 3B, 3C, and 4 as described above. In the example embodiments shown in Figures 3B, 3C, and 4, the connecting means comprises the connector 210, the receiving means comprises the lens 212, the guiding means comprises the lens 233 and mirror 235, and the confining means comprises the containment plenum 240.

Reference numbers are to the present application unless indicated otherwise. The present application at paragraphs 41-146 and Figures 1-19 illustrate various examples of the claimed invention.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether Claims 1-22 are unpatentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,977,515 issued to Uraki et al. ("Uraki") in view of U.S. Patent No. 6,507,000 issued to Otsubo et al. ("Otsubo"), U.S. Patent No. 6,693,255 issued to Freiwald ("Freiwald"), and U.S. Patent No. 3,369,101 issued to DiCurcio ("DiCurcio").

VII. ARGUMENT

Claims 1-22 Are Not Obvious in View of Uraki, Otsubo, Freiwald, and DiCurcio

It is well settled that the Examiner "bears the initial burden of presenting a *prima facie* case of unpatentability." *In re Sullivan*, 498 F.3d 1345 (Fed. Cir. 2007). To establish a *prima facie* case of obviousness, the Examiner must establish at least three elements. First, the prior art reference (or references when combined) must teach or suggest all of the claim limitations: "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 165 U.S.P.Q. 494, 496 (CCPA 1970); *see also M.P.E.P. § 2143.03*. Second, there must be a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091 (Fed. Cir. 1986); *see also M.P.E.P. § 2143.02*. And finally, the Examiner must articulate some reason to modify or combine the cited references that renders the claim obvious. Merely establishing that the claimed elements can be found in the prior art is not sufficient to establish a *prima facie* case of obviousness:

> As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (emphasis added).

Instead, the Supreme Court has made clear that the Examiner must establish a reason one of skill in the art would have combined the elements of the prior art, and that such reason must be more than a conclusory statement that it would have been obvious:

> Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit. *See In re Kahn,* 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741 (2007) (emphasis added).

Appellants respectfully submit that the Examiner failed to establish a *prima facie* case of obviousness as required by 35 U.S.C. § 103(a) for the reasons detailed below.

The Combination Of Uraki, Otsubo, Freiwald, And DiCurcio Does Not Disclose The Laser Head Recited By Claims 1-22

Uraki discloses an underwater laser system which comprises a plenum that isolates a dry, gas-filled region (in which the laser beam is able to propagate) from a surrounding water-filled region (Uraki, col. 8, lines 21-31). Uraki does not disclose or suggest that the plenum is "cooled by a cooling medium flowing through a coolant conduit," as recited by Claim 1 of the present application.

Otsubo discloses a dust collector which requires a gap (Otsubo, col. 2, lines 57-58) between the dust collector and the workpiece to draw ambient air into the dust collector from outside the dust collector (Otsubo, col. 3, lines 42-43). Otsubo does not disclose or suggest that the dust collector is "cooled by a cooling medium flowing through a coolant conduit," as recited by Claim 1 of the present application.

Freiwald discloses a cleaning head having a flow assembly in proximity to the surface being irradiated and an optics assembly upstream from the flow assembly (Freiwald, col. 6, lines 19-24 and Figures 2A, 2B, 3A, and 3B). The flow assembly allows the flow of ambient air to enter a nozzle from outside the cleaning head to cool the ablated material (Freiwald, col. 5, lines 40-44). Freiwald does not disclose or suggest that the ambient air cools the flow assembly and does not disclose or suggest that the flow assembly is "cooled by a cooling medium flowing through a coolant conduit," as recited by Claim 1 of the present application. In addition, while Freiwald discloses that the reflective optics (e.g. mirrors) of the optics assembly upstream from the flow assembly may be water-cooled (see, e.g., Freiwald, col. 8, lines 48-49), Freiwald does not disclose or suggest water-cooling the flow assembly.

DiCurcio discloses cooling a flash lamp and laser rod within an optical cavity using cooling gas from a cooling conduit (DiCurcio, col. 4, lines 25-28). However, DiCurcio does not disclose or suggest a containment plenum as recited by Claim 1 of the present application and does not disclose or suggest cooling other system components beyond the flash lamp and laser rod. Therefore, DiCurcio does not disclose or suggest a containment plenum that is "cooled by a cooling medium flowing through a coolant conduit," as recited by Claim 1 of the present application.

Therefore, Appellants submit that the combination of Uraki, Otsubo, Freiwald, and DiCurcio does not disclose or suggest a "containment plenum ... cooled by a cooling medium flowing through a coolant conduit of the containment plenum" as recited by Claim 1 of the present application. Similarly, Appellants submit that the combination of Uraki, Otsubo, Freiwald, and DiCurcio does not disclose a "confining means ... cooled by a coolant medium flowing through a cooling conduit of the confining means" as recited by Claim 19 of the present application. Therefore, since each of Claims 1 and 19 includes features which are not disclosed or suggested by the prior art, Appellants submit that Claims 1 and 19 of the present application are patentably distinguished over the cited prior art references.

Claims 2, 12, 14, 15, 17, 18, 20, 21, and 22 depend from Claim 1. Claims 3, 4, and 5 depend from Claim 2. Claims 6 and 7 depend from Claim 5. Claims 8, 9, 10, and 11 depend from Claim 7. Claim 13 depends from Claim 12. Claim 16 depends from Claim 15. Thus, each

of Claims 2-18 and 20-22 includes all the features of Claim 1 as well as other features of particular utility. Appellants note that at no time during the prosecution of the present application has the Examiner provided any basis for the rejection of Claims 2-18 and 20-22 by stating why these other features are disclosed or suggested by the prior art. Therefore, for at least the reasons discussed above for the patentability of Claims 1 and 19, Appellants submit that Claims 2-18 and 20-22 are also patentably distinguished over the cited prior art references.

It Would Not Be Obvious To Combine Uraki, Otsubo, Freiwald, and DiCurcio

In the January 11, 2008 Final Office Action, the Examiner states that it would have been obvious to one of ordinary skill in the art at the time of the invention to use a cooling conduit as taught by DiCurcio in the Uraki et al. system because "it is merely a part of the cooling system." However, Appellants submit that there is no suggestion or motivation to combine these two references. DiCurcio discloses a cooling conduit for cooling of an optical cavity to counteract heat generated by a flash lamp and laser rod within the optical cavity (DiCurcio, col. 4, lines 25-28). However, in Uraki, the optical cavity containing a heat-generating laser light generator is spaced well away from the containment plenum (see, e.g., Uraki, Figures 1, 2, 7, 8). Therefore, utilizing the cooling conduit disclosed in DiCurcio to cool the optical cavity of the Uraki system would not provide cooling of the containment plenum. Similarly, the cooling conduit disclosed by DiCurcio would not provide cooling of the dust collector of Otsubo or the flow assembly of Freiwald.

Furthermore, neither Uraki nor DiCurcio (nor Otsubo or Freiwald) disclose that the containment plenum is exposed to sufficient heat to warrant cooling using cooling conduits, and such knowledge was not known within the level of ordinary skill at the time the claimed invention was made, so persons skilled in the art would not expect such cooling to be useful. For example, and as discussed above, the systems of Uraki, Otsubo, Freiwald, and DiCurcio do not disclose a containment plenum exposed to sufficient heat to require cooling using cooling conduits. Uraki is designed for underwater welding (see Uraki, Abstract), Freiwald is designed for laser ablation cleaning of a surface using a nozzle spaced away from the surface (see Freiwald, Abstract; col. 5, lines 52-56), and Otsubo is designed for drilling small holes in work pieces (see Otsubo, Abstract, col. 1, lines 16-18). Thus, there is no motivation for persons

skilled in the art to modify the teachings of Uraki, Otsubo, or Freiwald using the teaching of DiCurcio. Without such a motivation to combine the cited references, the Examiner has not satisfied the requirements for a prima facie case of obviousness.

Furthermore, the system of the present application provides unexpected results. In contrast to the cited prior art, by having a containment plenum which confines and removes material from the interaction region as in the present application, enough heat can be generated to benefit from cooling of the containment plenum through cooling conduits. Thus, the unexpected result of benefit from cooling the containment plenum provided by the system of the present application is supportive of the non-obviousness of the claimed invention. ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007)).

Furthermore, it would not be obvious to combine Uraki, Otsubo, and Freiwald since doing so would yield no expectation of success, and would render the modified prior art unsatisfactory for its intended purpose. Freiwald teaches a cleaning head with a vacuum system that draws ambient air through an aperture 36 to cool and clear ablated material (see, e.g., Freiwald Figures 3A, 3B, and col. 6, lines 52-67). The nozzle in Freiwald is necessarily spaced away from the surface being ablated. For example, Freiwald discloses that "the nozzle rides a few millimeters above the surface being cleaned" (Freiwald, col. 6, lines 55-57). Indeed, Freiwald states, "The cleaning head **must permit some ambient air to enter the nozzle**, in order to cool the ablated material and dilute and entrain the ablated material for easier filtration" (Freiwald, col. 5, lines 40-44 (emphasis added)). Similarly, Otsubo teaches having a gap E between the laser drilling machine and the workpiece which is "required for allowing free movements of the workpiece 4" (Otsubo, col. 2, lines 57-58). Furthermore, Otsubo teaches that "air may be drawn in from outside through this gap E" (Otsubo col. 3, lines 42-43).

However, if the system of Uraki were spaced some distance away from the surface being irradiated as taught by Freiwald or by Otsubo, water from the surrounding environment would flood the chamber, preventing operation. Similarly, if the system of Freiwald or of Otsubo were pressed tightly against the surface being cleaned, it would be unable to draw ambient air from the surrounding environment or would be unable to move. Moreover, the ambient air required by

Freiwald is unavailable for the system disclosed by Uraki because Uraki teaches use of the chamber underwater. Accordingly, it would not have been obvious to modify Uraki using the teachings of Freiwald or Otsubo because the system disclosed by Uraki, as modified by Freiwald or Otsubo, would be rendered unsatisfactory for its intended purpose. If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. M.P.E.P. § 2143.01(V). For at least the above-stated reasons, it would not have been obvious to combine Uraki with Freiwald and Otsubo.

Conclusion

In view of the foregoing, Appellants respectfully submit that the rejections of Claims 1-22 are not well founded. Appellants therefore respectfully request that the Board reverse the rejection of Claims 1-22.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

1. A laser head adapted to irradiate an interaction region of an inhabitable structure with laser light to remove material from the structure, the laser head comprising:

a housing;

a connector coupled to the housing and optically coupled to a laser generator, the connector adapted to transmit laser light from the laser generator;

at least one optical element contained in the housing and optically coupled to the connector, the optical element adapted to receive laser light from the connector; and

a containment plenum coupled to the housing, the containment plenum optically coupled to the optical element to receive the laser light from the optical element, the containment plenum adapted to confine the material and remove the material from the interaction region resulting from irradiating the structure with the laser light, wherein the containment plenum is cooled by a cooling medium flowing through a coolant conduit of the containment plenum, the coolant conduit fluidly coupled to a source of the cooling medium that is spaced from the containment plenum.

2. The laser head of Claim 1, wherein the housing comprises a distal portion coupled to the connector, an angle portion coupled to the distal portion, and a proximal portion coupled to the containment plenum, and the at least one optical element comprises a mirror in the angle portion.

3. The laser head of Claim 2, wherein the mirror is either air-cooled or water-cooled.

4. The laser head of Claim 2, wherein the mirror is mounted on an adjustable assembly in the angle portion, whereby alignment of the laser light can be optimized by adjusting the assembly.

5. The laser head of Claim 2, wherein the distal portion comprises a generally straight first tube through which laser light propagates to the mirror, and the proximal portion comprises a generally straight second tube through which the laser light from the mirror propagates.

6. The laser head of Claim 5, wherein the second tube is substantially perpendicular to the first tube.

7. The laser head of Claim 5, wherein the housing further comprises a second angle portion coupled to the first angle portion and the proximal portion, the at least one optical element further comprising a second mirror in the second angle portion, whereby laser light propagates through the first tube, is reflected by the first mirror, is reflected by the second mirror, and propagates through the second tube.

8. The laser head of Claim 7, wherein the first angle portion is rotatably coupled to the distal portion.

9. The laser head of Claim 7, wherein the first angle portion is rotatably coupled to the distal portion.

10. The laser head of Claim 7, wherein the second tube is substantially parallel to, and displaced from, the first tube.

11. The laser head of Claim 7, wherein the second mirror is mounted in an adjustable assembly in the second angle portion, whereby alignment of the laser light can be optimized by adjusting the assembly.

12. The laser head of Claim 1, wherein the at least one optical element further comprises a lens in the distal portion through which the laser light propagates.

13. The laser head of Claim 12, wherein the lens is mounted in an adjustable assembly in the distal portion, whereby alignment and focus of the laser light can be optimized by adjusting the assembly.

14. The laser head of Claim 1, wherein the connector is optically coupled to the laser generator via an optical fiber.

15. The laser head of Claim 1, wherein the at least one optical element comprises a lens in the connector, the lens collimating the laser light.

16. The laser head of Claim 15, wherein the lens is mounted in an adjustable assembly in the connector, whereby alignment and focus of the laser light can be optimized by adjusting the assembly.

17. The laser head of Claim 1, wherein the optical element is either air-cooled or water-cooled.

18. The laser head of Claim 1, further comprising a sensor adapted to measure the relative distance between the laser head and the interaction region.

19. A laser head adapted to irradiate an interaction region of an inhabitable structure with laser light to remove material from the structure, the laser head comprising:

means for connecting the laser head to a laser generator;

means for receiving the laser light from the laser generator;

means for guiding the laser light to the interaction region; and

means for confining the material and removing the material from the interaction region, the confining means being cooled by a coolant medium flowing through a cooling conduit of the confining means, the coolant conduit fluidly coupled to a source of the cooling medium that is spaced from the confining means.

20. A method of irradiating an interaction region of an inhabitable structure with laser light to remove material from the structure, the method comprising:

providing a laser head as described in Claim 1;

transmitting laser light from the laser generator through the laser head;

guiding the laser light to the interaction region of the structure; and

confining the material and removing the material from the interaction region.

21. The laser head of Claim 1, wherein the cooling medium is water.

22. The laser head of Claim 1, wherein the cooling medium is air.

IX. EVIDENCE APPENDIX

1. U.S. Patent No. 5,977,515 issued to Uraki et al.; cited by the Examiner in the January 11, 2008 Final Office Action.
2. U.S. Patent No. 6,507,000 issued to Otsubo et al.; cited by the Examiner in the January 11, 2008 Final Office Action.
3. U.S. Patent No. 6,693,255 issued to Freiwald; cited by the Examiner in the January 11, 2008 Final Office Action.
4. U.S. Patent No. 3,369,101 issued to DiCurcio; cited by the Examiner in the January 11, 2008 Final Office Action.

X. RELATED PROCEEDINGS APPENDIX

1. Notice of Appeal and Pre-Appeal Brief Request for Review filed in U.S. Application No. No. 11/401,116, entitled "Manipulation Apparatus for System that Removes Material from a Surface of a Structure."
2. Notice of Appeal and Pre-Appeal Brief Request for Review filed in U.S. Application No. 11/401,114, entitled "Method and Apparatus for Material Processing."